



**Barcelona
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Centro Nacional de Supercomputación



EXCELENCIA
SEVERO
OCHOA

EARTH SYSTEM SERVICES

Seasonal and sub-seasonal climate predictions

Francisco Doblas-Reyes
Earth Sciences Department



- Environmental modelling and forecasting
- Resulting from a merging process between



Climate Forecasting Unit



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- Structure: four groups (50 people), funded by public and private sources

COMPUTATIONAL EARTH SCIENCES

ATMOSPHERIC
COMPOSITION

CLIMATE
PREDICTIONS

EARTH SYSTEM SERVICES

OUR OBJECTIVE:

Facilitate technology transfer of state-of-the-art research from local, national to international levels in five areas

Air quality assessments

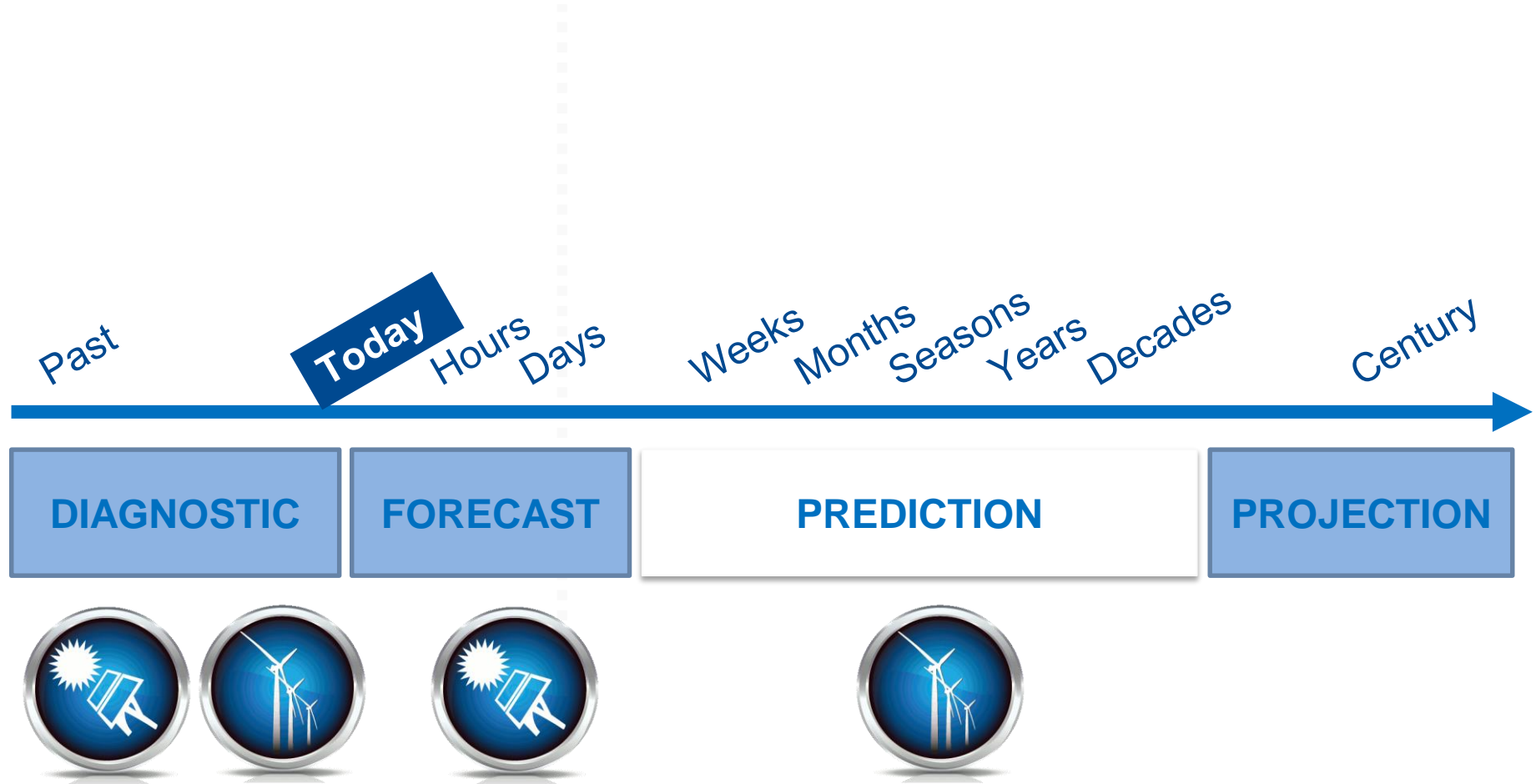
Mineral dust modelling

Weather and air quality forecasting

Climate predictions

Computational Earth services







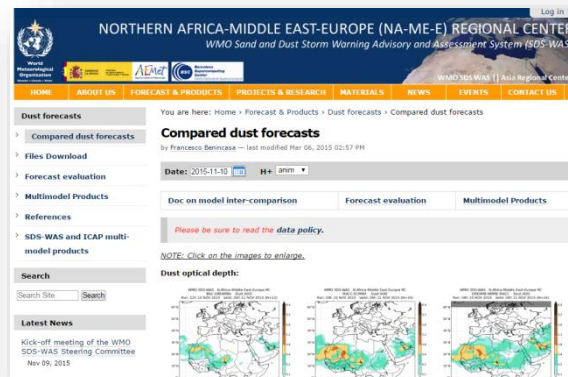
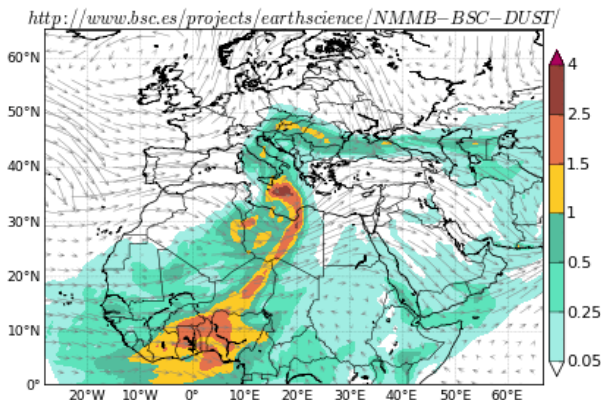
1. Mineral dust assessment

BSC has developed in collaboration with NCEP the NMMB/BSC-Dust model.

- REGIONAL AND GLOBAL SCALES
- ON-LINE FEEDBACKS: DUST-RADIATION INTERACTION

2. Forecast system

Provides early-warning information about current and future dust concentration and derived parameters critical for specific sectors.



ESS partnership in EU Projects in climate services for the energy sector



SPECS: Seasonal-to-decadal climate Prediction for the improvement of European Climate Services



EUPORIAS: EUropean Provision Of Regional Impact Assessment on a Seasonal-to-decadal timescale



NEWA: New European Wind Atlas



PRIMAVERA: Process-based climate simulation: advances in high-resolution modelling and European climate risk assessment



IMPRES: Improving predictions and management of hydrological Extremes



CLIM4ENERGY: Climate for Energy

e.g. Seasonal wind speed predictions



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RESILIENCE PROTOTYPE

- Forecasts from **ECMWF** (European Centre for Medium-Range Weather Forecasts), soon a multi-model
- We assess the global behaviour providing **probabilistic information of the resource**
- Aggregated output in **terciles**:
 - Above normal
 - Normal
 - Below normalOther options possible

ASSESSMENT REPORT 1: Dec-Jan-Feb 2009, US

Key event characterisation

Description

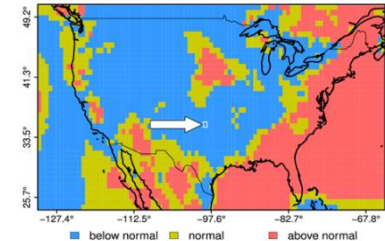
US ERA-Interim 10m wind speed tercile categories (DJF 2009)

a

AREA: US

SEASON: December-January-February (DJF)

YEAR: 2009/2010



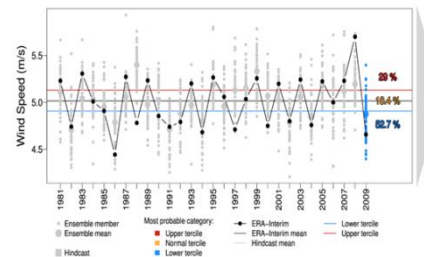
RESILIENCE seasonal wind speed prediction

b

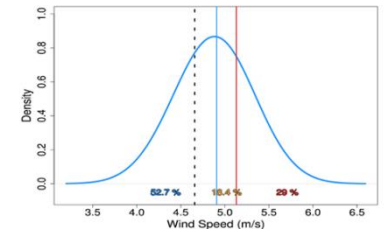
Time series of 10-m wind speed calibrated from ECMWF System 4 and ERA-Interim reanalysis (DJF 1981-2009)

Skill assessment and probability density function (DJF 2009 prediction)

c



Skill: Corr=0.543 RPSS=0.226 CRPSS=0.115



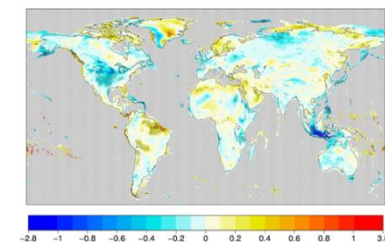
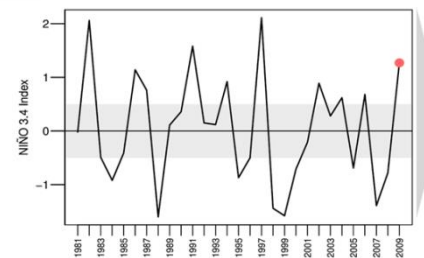
Mechanisms driving seasonal wind speed variability

d

Time series of the Oceanic Niño 3.4 Index (ONI) (DJF 1981-2009)

Impact of the positive phase of Niño 3.4 on the 10-m wind speed (DJF 1981-2014)

e



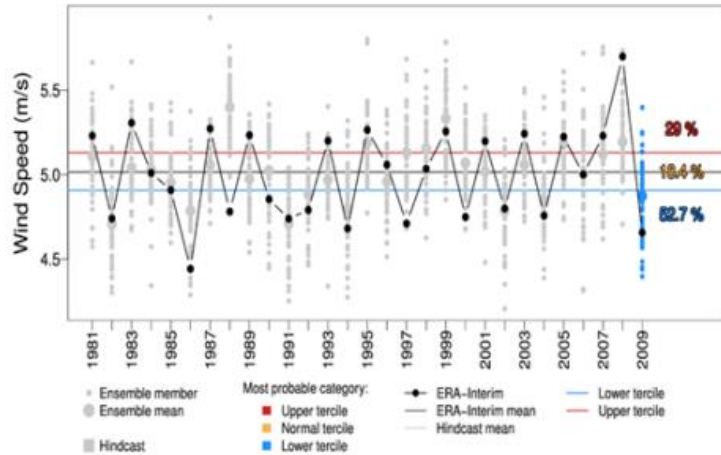
e.g. Seasonal wind speed predictions



RESILIENCE seasonal wind speed prediction

b

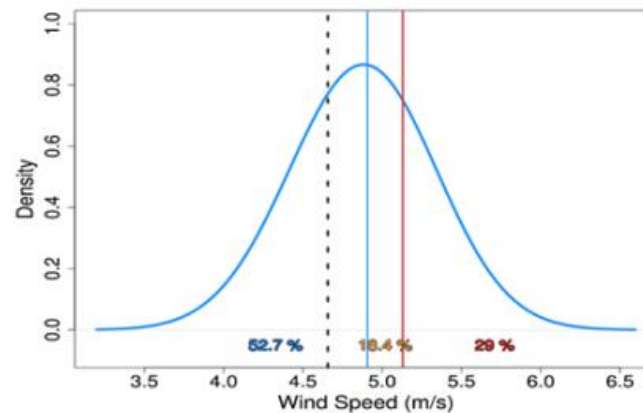
Time series of 10-m wind speed calibrated from ECMWF System 4 and ERA-Interim reanalysis (DJF 1981–2009)



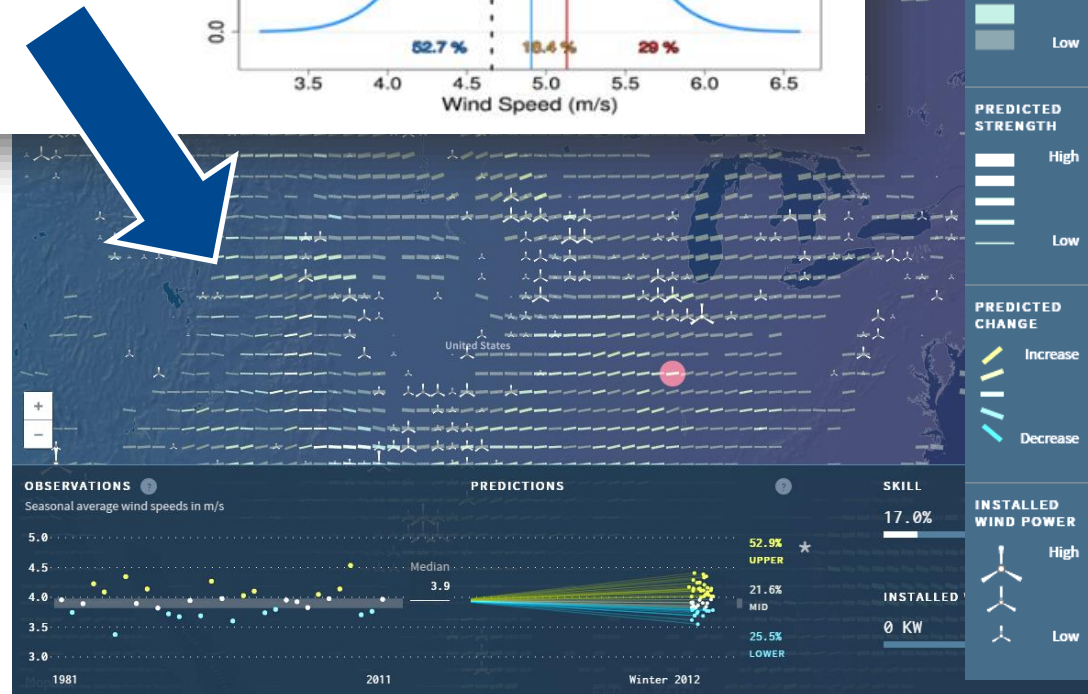
Skill assessment and probability density function (DJF 2009 prediction)

c

Skill: Corr=0.543 RPSS=0.226 CRPSS=0.115



On-line visualization tool for the
RESILIENCE prototype



e.g. Climate drivers of seasonal variability

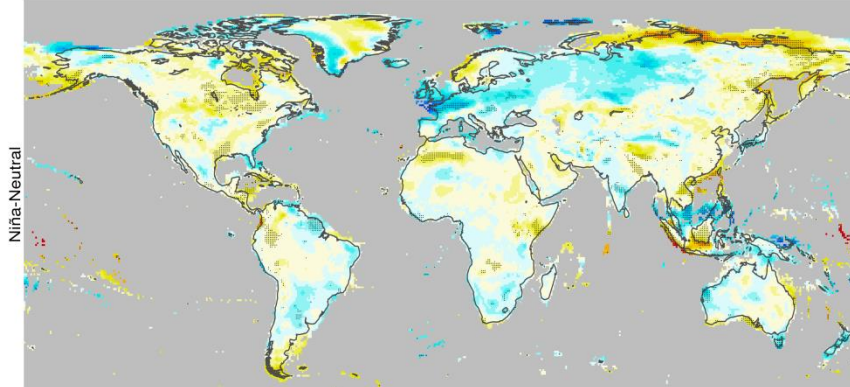
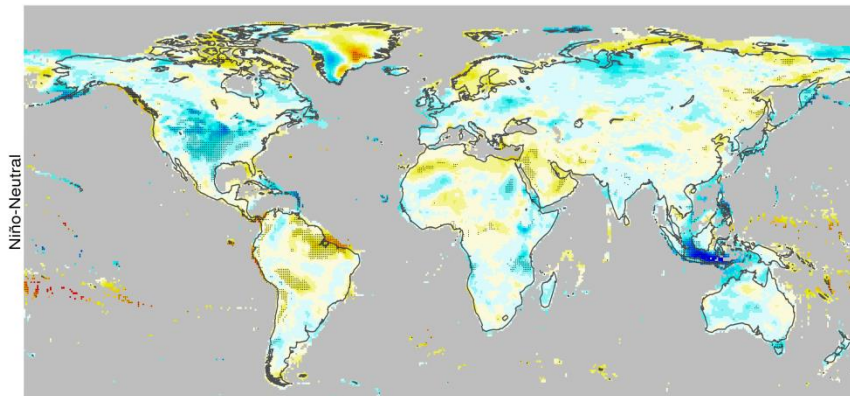


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DJF Wind difference (ONI), 1981-2014 (m/s)

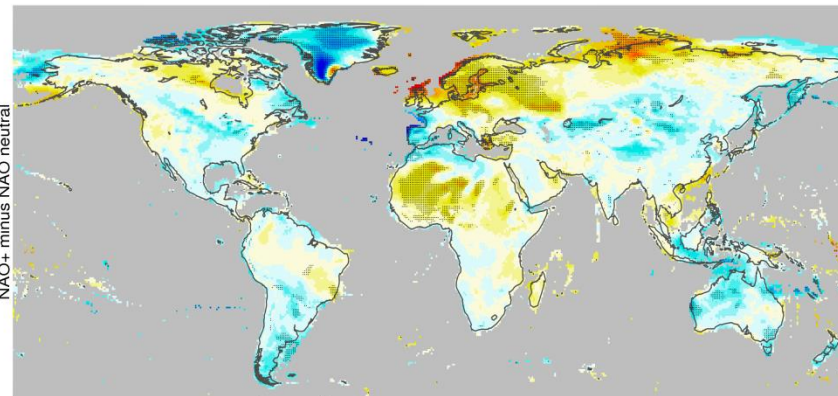
Niño



DJF Wind difference (NAO), 1981-2014 (m/s)

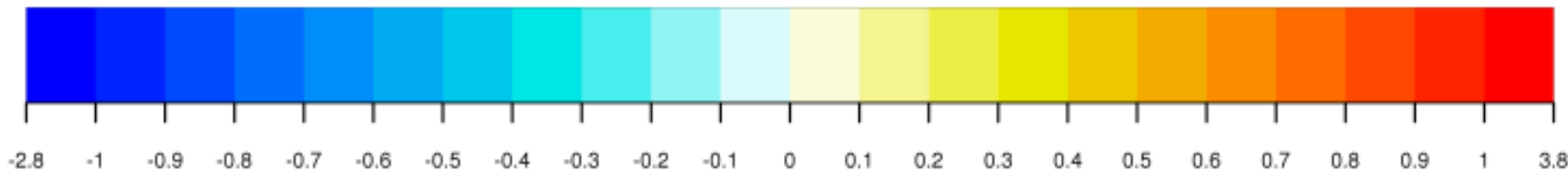
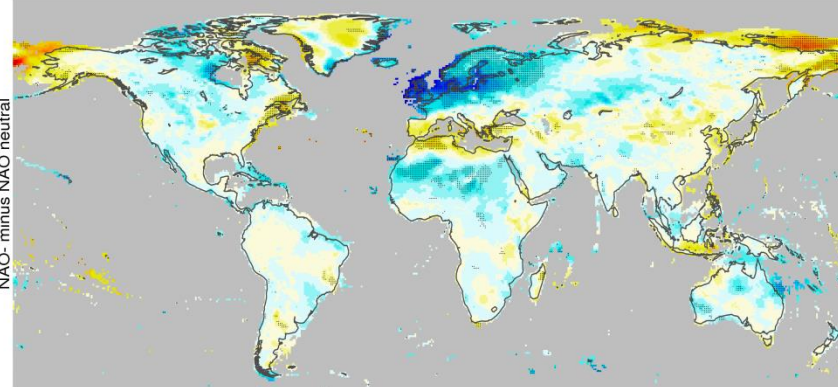
NAO +

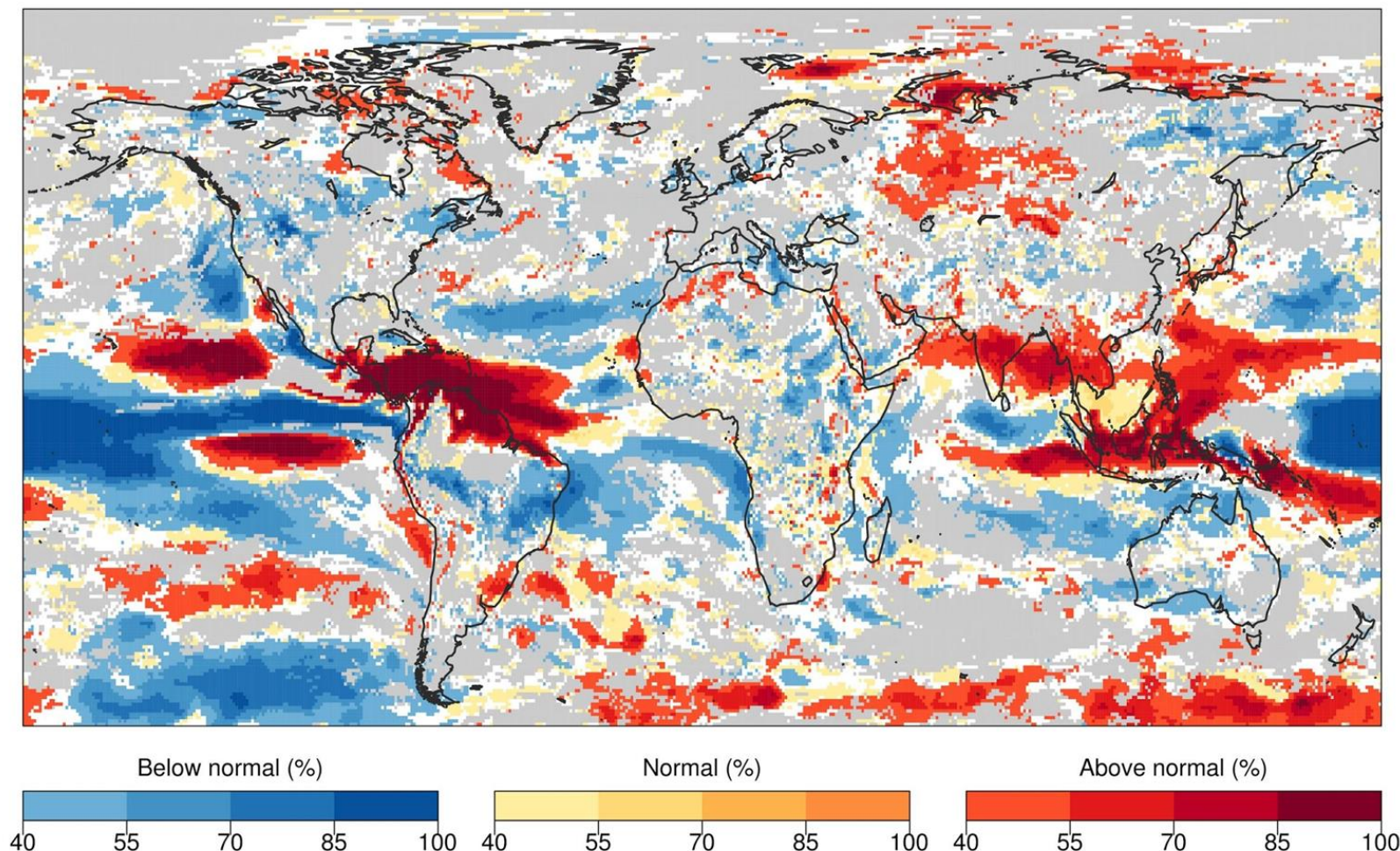
NAO+ minus NAO neutral



NAO -

NAO- minus NAO neutral

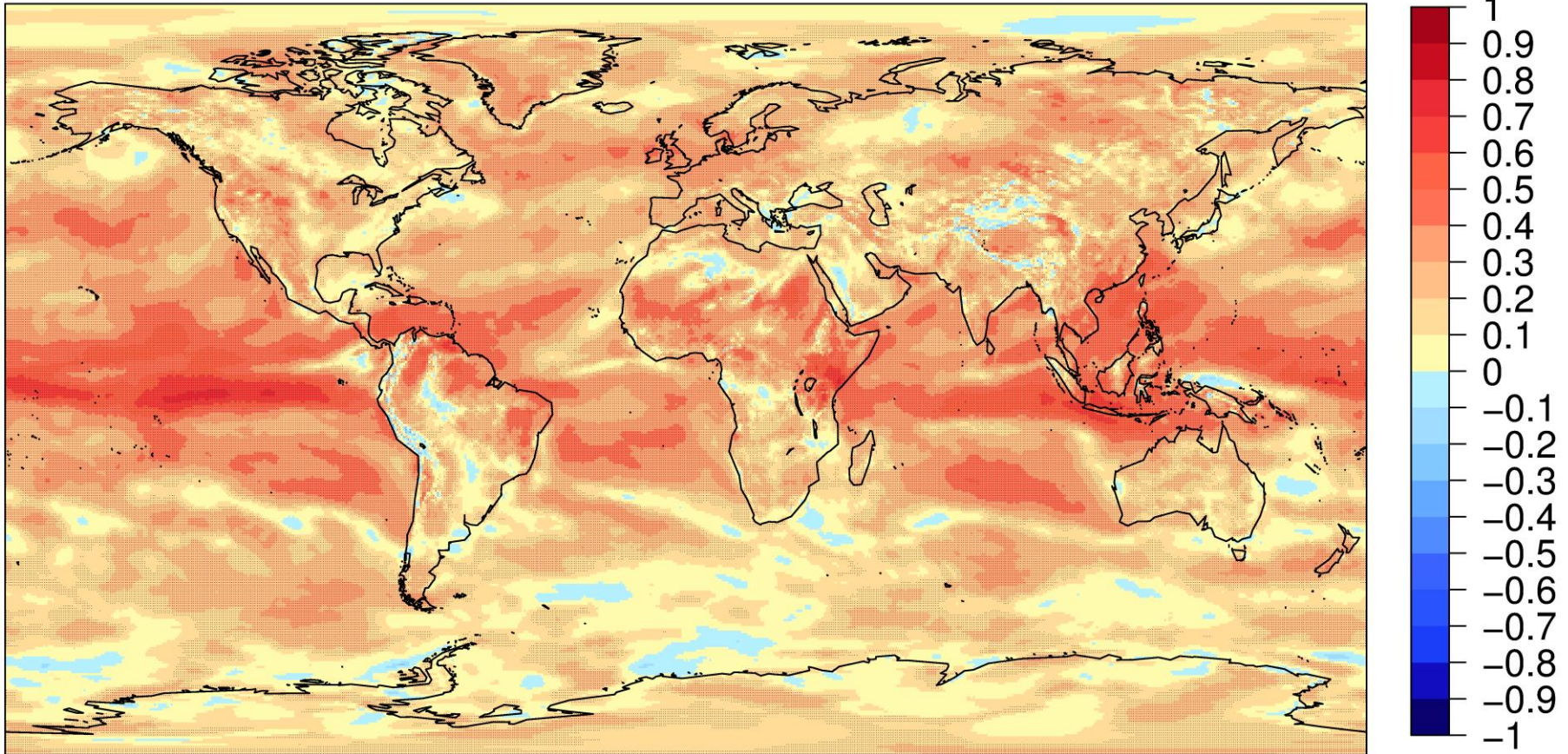




Wind speed prediction for June 1st - August 31st 2015, issued on May 1st 2005.

The most likely wind power category (below normal, normal or above normal), and its percentage probability to occur is shown. "Normal" represents the average of the past. White areas show where the probability is <40% and approximately equal for all three categories. Grey areas show where the climate prediction model does not improve upon the standard and current approach, which projects past climate data into the future.

Correlation of ECMWF Monthly Prediction System 10m Wind Speed for Jan_Feb. Forecast time 12–18.



Pre-Construction Decisions: **Annual to Decadal** Timescales

- **Wind farm planners:** Site selection
- **Wind farm investors:** Evaluate return on investments
- **Policy makers:** Understand changes to energy mix

Post-Construction Decisions: **Monthly to Seasonal** Timescales

- **Energy producers:** Resource management strategies
- **Energy traders:** Resource effects on markets
- **Wind farm operators:** Planning for maintenance works
- **Wind farm investors:** Optimize return on investments



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Thank you!

For further information please contact
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